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Technical Applications Division (TAPPS)

Habitat Program

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TECHNICAL APPLICATIONS (TAPPS) DIVISION

INTRODUCTION

Cool, unpolluted water; food-producing areas; large woody debris for cover; clean spawning gravels; unobstructed fish passage; safety from stranding or impingement- these are some of the habitat conditions salmonids need to thrive. Within the Habitat Program, the Technical Applications (TAPPS) Division develops, implements and evaluates habitat projects statewide and provides professional technical assistance that directly support state, local, and federal initiatives to maintain and restore wild salmonid populations and their habitat. While achieving these goals, the TAPPS Division staff utilize and develop the best available science in restoring ecological functions, maintaining natural processes whenever possible, and improving habitat conditions for fish and wildlife.

The TAPPS Division is organizationally divided into three sections: the Habitat Engineering Technical Assistance (HETA) Section, the Environmental Restoration Technical Assistance (ERTA) East Section (Eastern Washington) and the ERTA West Section (Western Washington - formerly known as Salmonid Screening Habitat Enhancement and Restoration or SSHEAR).

ERTA EAST AND WEST

ERTA East specializes in promoting fish passage and screening associated with surface water and pump water diversions. They also conduct fish passage and screening inventories and physical habitat assessment in Eastern Washington.

ERTA West specializes in conducting fish passage and screening inventories, and physical habitat assessment and training in the use of fish passage barrier, screening and habitat assessment protocols. Biologists in ERTA West are technical experts on fish passage, fishways (correction, inspection, and maintenance) and Western Washington salmonid habitat restoration.

TAPPS/ ERTA TECHNICAL ASSISTANCE

TAPPS personnel provide professional technical assistance that directly support state, local, and federal initiatives to maintain and restore wild salmonid populations and their habitat. TAPPS expertise comes from years of combined staff experience in habitat assessment, fish passage and screening inventory and project work, data management, salmonid research, environmental engineering, and habitat project construction and evaluation.

TAPPS personnel provide technical assistance to Regional Fishery Enhancement Groups (RFEG's), Lead Entities (LE's), citizens, State, Federal, Local and Tribal governments, Watershed Planning Committees, Salmon Recovery Funding Board (SRFB), WDFW Watershed Stewards and Area Habitat Biologists, and others.

The Technical Applications Division website has been updated and provides access to ERTA and HETA resources over the Internet. The TAPPS website is located at:
<http://wdfw.wa.gov/hab/tapps/index.htm>.

ERTA technical assistance biologists are assigned to different regions around the state in order to provide a regional service. ERTA staff work cooperatively with HETA habitat engineers who are also regionally deployed, to provide interdisciplinary technical assistance with aquatic habitat restoration, fish screening, and fish passage. This assistance can be in the form of direct interaction, formal training, surveying, site assessment, project scoping, and or construction/ project management.

ERTA staff are available to provide training and technical assistance to grant groups and others interested in conducting fish passage and screening inventories and habitat assessments, using the protocols discussed in the *Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual*. Table 1 shows the groups that TAPPS personnel have provided fish passage and screening inventory training and technical assistance to. Personnel are also available to give presentations on fish passage at various meetings and workshops around the state.

Table 1. Groups provided inventory training and technical assistance by ERTA staff.

Group	Watershed(s)¹	Status
Adopt-A-Stream Foundation	Swamp, Little Bear, Allen, North, and Quilceda creeks	Ongoing
Washington Trout	Skykomish, Snohomish, and Snoqualmie rivers	Ongoing
Skagit System Cooperative	Skagit River	Ongoing
Yakama Tribe	Klickitat River	Ongoing
Hood Canal Salmon Enhancement Group	Miscellaneous Hood Canal tributaries	Ongoing
Squaxin Island Tribe	Oakland Bay tributaries	Ongoing
Quileute Tribe	Bogachiel River	Ongoing
Lower Columbia Fish Recovery Board	Washougal River	Ongoing
Governor's Council on Environmental Education	Statewide	Ongoing
Whatcom County Conservation District	Whatcom County	Ongoing
Eastern Washington Forest and Fish Biologists	Eastern Washington	Ongoing
Hoh Tribe	Goodman Creek	Ongoing
Western Washington Forest and Fish Biologists	Western Washington	Ongoing
Western Washington Watershed Stewards	Western Washington	Ongoing
King County Roads Dept.	King County	Ongoing
WDFW Region 4 Habitat Biologists	Region 4	Ongoing
Northwest Service Academy	Klickitat County	Completed
Lewis County Conservation District	Lewis County	Ongoing
Mason County Conservation District	Satsop, Humptulips, Wynoochee rivers	Ongoing
Eastern Washington Watershed Stewards	Eastern Washington	Ongoing
Pacific County Conservation District	Pacific County	Ongoing
Yakima Tributary Access and Habitat Program	Yakima River Tributaries	Ongoing
Adopt-A-Stream Foundation	Snohomish County	Ongoing
Nooksack Tribe	Whatcom County (Private Ownership)	Ongoing
Nooksack Salmon Enhancement Association (NSEA)	Whatcom County (Private Ownership)	Ongoing
Pend Oreille Conservation District	Pend Oreille County	Ongoing
Dept. of Navy/Batelle PNWL	Dept of Navy Railroads	Ongoing
Puget Creek Restoration Society	Selected Streams in WRIA 10	Completed
Department of Natural Resources	Forested Lands Statewide	Ongoing

¹Usually does not include the entire watershed

ERTA EAST

INTRODUCTION

Overall responsibility for the statewide fish-screening program is retained within the WDFW Habitat Program Technical Applications (TAPPS) Division. In addition, a watershed inventory crew was established in 2003 to implement comprehensive fish passage barrier and screening inventories in selected watersheds in Eastern Washington. This report summarizes the 2003 accomplishments for the TAPPS ERTA East (Yakima) Section.

FISH SCREEN TECHNICAL ASSISTANCE

Fish screen technical assistance is offered and performed by TAPPS Division personnel based out of Yakima, WA, who provide ongoing technical assistance to irrigation diversion owners, irrigation equipment vendors, and local, State and Federal agency personnel, as well as consultants, contractors, and general public. In 2003, numerous contacts were made regarding fish screening technical assistance. Staff attended several workshops sponsored by various organizations, where practical information relative to fish screening was provided to various technical workgroups.

FISH SCREENING AND PASSAGE PROJECTS - 2003

TAPPS personnel managed the successful completion of various screening and passage projects. In collaboration with WDFW Business Services Program Engineering/ Construction Division, one fish passage project was completed, one fish passage project was partially completed, and one fish-screening project was completed. Those projects are identified in Table 3. Additionally, one fish screen was fabricated in preparation for installation in 2004.

Big Creek (WRIA 39) Fish Passage Construction - The purpose of the project was to provide fish passage and screening at the current diversion dam. Providing fish passage will open up ~10 miles of high quality habitat to anadromous fish species. This was accomplished through the installation of a series of concrete and rock weirs that will act as gradient controls and dissipate stream energy, such that the structure will survive high flow events and allow for bedload transport and other natural processes. Installation of self-cleaning fish screens will prevent fish from being entrained into irrigation canals. Finally, water conservation would be accomplished through improved diversion and piping to on-farm use areas. Specific species that will benefit include: Federally listed steelhead and bull trout, chinook salmon, rainbow trout, cutthroat trout, sculpin and any other resident fish or aquatic organisms.

Huntsville Mill (WRIA 32) Drum Screen Install and Fish Passage Construction - The WDFW received funding from the Bonneville Power Administration for replacement of the obsolete Huntsville Mill fish screen facility that did not meet current WDFW and National Marine Fisheries Service (NOAA Fisheries) criteria for fish protection. The WDFW constructed a new fish screen

facility that complies with all current state and federal fish protection criteria. This new facility was designed for flows up to 6.5 cubic feet per second (cfs). The facility consists of a concrete structure, one 3' diameter X 8' long electrically driven drum screen, seasonal lift gantry, trash rack, security fence, and 12" diameter PVC buried bypass pipe approximately 120' long. The new facility was located at the existing screen site, which was demolished and removed from the premises. In addition to the new screen facility, a new metal head gate was fabricated and a concrete structure was constructed up near the point of diversion from the Touchet River. Finally, an engineered permanent rock sill was constructed within the Touchet River. The rock sill was constructed to span the width of the river just below the point of diversion, and allows unimpeded movement of migrating fish while providing the diversion adequate flow.

Mill Creek (WRIA 32) Stiller Portable Modular Screen Fabrication - The WDFW utilized state funding for construction of a fish passage structure and new fish screen on the Stiller irrigation diversion on Mill Creek in Walla Walla County. The WDFW fabricated a new fish screen structure complies with all current state and federal fish protection criteria. This new structure was designed for flows up to 3.6 cubic feet per second (cfs). The structure consists of a prefabricated modular paddle wheel driven drum screen. In addition to the new screen structure, a new metal head gate was fabricated. Installation of the fabricated screen will likely be done through Walla Walla Conservation District.

Table 3. 2003 Fish Screen and Fish Passage Construction Projects

Project Name	Description	Month Completed
Big Creek	Fish passage construction (partial)	12/03
Huntsville Mill	Drum screen install and fish passage construction	12/03
Stiller	Portable modular fabrication	8/03

EASTERN WASHINGTON FISH PASSAGE INVENTORY

The ERTA East inventory crew completed a comprehensive barrier inventory on Ahtanum Creek, a tributary to the Yakima River. In summary, the crew identified 31 fish passage barriers and 26 unscreened or inadequately screened irrigation diversions within the Ahtanum watershed. Additionally, an Ahtanum Creek tributary team will be established in the near future, under the direction of the Yakima Tributary Access and Habitat Program (YTAHP). This team will develop and implement a tributary work plan and prioritization scheme that will be used in the correction of the features identified during the inventory effort.

The inventory crew began the Okanogan River watershed fish passage and screening inventory in late 2003.

ERTA WEST

FISH PASSAGE BARRIER IDENTIFICATION & CORRECTION

INTRODUCTION

Resident and anadromous salmonids are a vital component of the culture and economy of the Pacific Northwest. Each year, millions of dollars in revenues are generated in Washington, Oregon, and California by sport and commercial fisheries targeting salmon and trout. In addition, the presence and abundance of salmonids are indicators of the health of Pacific Northwest stream ecosystems. Without question, protection and enhancement of salmonids and the habitats that supports them directly enhance the distribution and abundance of many other wildlife species as well.

Correction of human-made fish passage barriers, such as impassable culverts, dams, tidegates, floodgates, or degraded fishways is one of the most cost effective methods of salmonid enhancement and restoration. In many cases, access to several miles of quality salmon and trout spawning or rearing habitat can be restored by eliminating a single fish passage barrier.

To address these problems, the TAPPS Division performs several major functions:

- fishway inspection and maintenance consultation,
- fishway major project development,
- fish passage and screening inventory work,
- habitat assessment,
- fish passage and screening database management,
- fish passage, road abandonment, screening and habitat restoration projects,
- training/consultation on fish passage related issues,
- inspection and maintenance of the Granite Falls Fishway on the Stillaguamish River, and
- operation of the Sunset Falls trap and haul fish passage facility to provide anadromous salmonid access to more than 90 miles of quality habitat in the upper Skykomish River watershed.

The unit is composed of experienced environmental specialists, fish biologists and scientific technicians. Following is a summary of work completed.

FISHWAYS

TAPPS is responsible for the inspection and evaluation of 606 fishways statewide. The purpose of this program is to ensure that the 3,000 miles of habitat associated with those fishways is available to fish. The majority of the fishways are associated with road culverts and small low head dams. Inspections are conducted in the spring, after the threat of major flooding and damage, so that the condition of the fishways can be adequately evaluated. For those fishways requiring maintenance, fishway notification letters are sent out with follow-up calls made to the owners. Where necessary, WDFW staff schedule an on site consultation with the fishway owner to resolve any outstanding problems affecting fish passage.

Compliance inspections are conducted in the late summer/early fall to ensure that identified maintenance work has been completed. During 2003, 428 fishways received scheduled inspections. Of this number, 113 (26%) required maintenance or reconstruction. Compliance inspections conducted later in the year showed that 38 fishways had been restored to provide durable and efficient fish passage. Most of the fishways not in compliance were those requiring major reconstruction. WDFW continually works with those owners to ensure that a time line for reconstruction is developed and implemented. The correction compliance rate of 34% for 2003 was below the last ten-year average of 37%. Funding for TAPPS Fishway Inspection and Maintenance Program was eliminated in 2004. In the future, continued technical assistance will be provided to fishway owners on a request basis only. TAPPS will work with WDFW region staff and other programs to inspect and maintain WDFW-owned fishways to ensure unrestricted fish passage.

WDFW is responsible for the operations, maintenance and repair of 76 fishways statewide, including 24 Mitchell Act fishways on the lower Columbia River. In addition, the Habitat Program operates and maintains the Granite Falls fishway on the South Fork Stillaquamish River and the Sunset Falls fishway on the South Fork Skykomish River. In 2003, the Granite Falls fishway required about 3.3 staff months for weekly monitoring and maintenance activities during the salmon and steelhead run. In 2003, the Sunset Falls fishway required 15.8 staff months for the trapping and transporting of fish from July through December in addition to needed maintenance during the off season.

Sunset Falls (WRIA 07) Fishway

Built in 1958, the Sunset Falls fishway (South Fork Skykomish River WRIA 07.0012, located at river mile 51.5) consists of a series of 33 vertical slots, which lead into a trap and haul facility. The facility provides salmon, steelhead, and native char access to over 92 miles of spawning and rearing habitat in the upper South Fork Skykomish watershed. Table 2 lists the numbers by species passed upstream of Sunset Falls, since 1958. 2003 marked the third largest return of adult pink salmon (18,857) to the fishway since operations began in 1958. The largest return of pink salmon to the fishway was in 1985 when 22,204 were trapped and hauled above the falls. In summary, 52,768 fish were trapped and hauled above the falls in 2003. This is second only to the largest recorded run in 2001 when 66,670 fish were trapped and hauled above the fishway.

Table 2. Fish trapped and transported upstream at Sunset Falls between 1958 - 2003.

<i>Dates of Operation</i>		<i>Season Totals</i>										
from	to	Coho	Coho jacks	Chinook	Chinook jacks	Pink	Chum	Sockeye	Steelhead	Bull Trout	Cutthroat	Total
09/18/58	01/02/59	1,561	NC	47	NC	0	10	0	88	NC	NC	1,706
03/16/59	12/29/59	2,311	137	70	25	150	4	5	112	NC	NC	2,814
08/30/60	12/30/60	5,032	412	155	13	0	4	1	56	NC	NC	5,673
08/11/61	01/16/62	8,901	297	165	37	49	1	35	50	NC	NC	9,535
07/28/62	02/18/63	10,916	206	619	211	0	1	34	136	NC	NC	12,123
07/08/63	01/06/64	12,507	421	362	161	278	0	29	207	NC	NC	13,965
06/12/64	02/04/65	13,666	409	454	228	0	0	17	83	NC	NC	14,857
07/06/65	01/28/66	13,148	241	714	197	505	2	21	98	NC	NC	14,926
07/15/66	12/28/66	16,947	338	768	191	0	4	6	819	NC	NC	19,073
08/09/67	12/18/67	16,347	82	915	412	751	2	10	278	NC	NC	18,797
08/14/68	12/06/68	20,342	102	901	460	0	4	7	192	NC	NC	22,008
04/08/69	12/27/69	9,896	50	1,313	543	970	2	13	106	NC	NC	12,893
06/29/70	12/23/70	26,510	133	1,357	753	1	14	46	303	NC	NC	29,117
06/22/71	12/28/71	21,650	109	1,279	702	1,819	3	17	459	NC	NC	26,038
07/07/72	01/05/73	11,731	59	1,257	439	6	4	9	420	NC	NC	13,925
07/10/73	12/27/73	12,733	64	1,226	289	854	4	13	395	NC	NC	15,578
07/01/74	12/26/74	17,813	90	1,570	290	0	10	3	485	NC	NC	20,261
07/07/75	12/19/75	16,719	84	776	269	841	2	12	465	NC	NC	19,168
07/07/76	12/17/76	12,151	61	888	266	0	5	7	292	NC	NC	13,670
07/05/77	12/09/77	18,244	92	468	212	624	8	69	843	NC	NC	20,560
07/25/78	12/15/78	19,787	601	463	110	0	2	2	598	NC	NC	21,563
07/30/79	12/28/79	30,041	94	463	388	1,410	0	0	412	NC	NC	32,808
07/22/80	12/30/80	23,960	91	559	220	0	22	12	1,196	NC	NC	26,060
07/14/81	12/11/81	15,506	34	513	120	2,393	0	8	1,137	NC	NC	19,711
08/23/82	12/22/82	10,683	54	187	73	0	3	3	636	NC	NC	11,639
07/07/83	12/15/83	15,515	40	177	116	7,789	0	3	442	NC	NC	24,082
07/10/84	12/13/84	4,824	16	161	126	0	1	2	1,579	NC	NC	6,709
07/09/85	12/19/85	8,693	97	307	125	22,204	0	5	1,565	NC	NC	32,996

Table 2 (continued). Fish trapped and transported upstream at Sunset Falls between 1958 - 2003.

<i>Dates of Operation</i>		<i>Season Totals</i>										
from	to	Coho	Coho jacks	Chinook	Chinook jacks	Pink	Chum	Sockeye	Steelhead	Bull Trout	Cutthroat	Total
07/08/86	12/19/86	18,929	84	530	197	0	182	13	1,245	NC	NC	21,180
07/06/87	12/17/87	13,472	146	406	52	17,276	0	21	1,414	NC	NC	32,787
07/03/88	12/16/88	17,935	212	690	101	0	29	0	2,048	NC	NC	21,015
07/05/89	12/23/89	16,396	178	484	32	21,794	16	21	502	NC	NC	39,423
07/09/90	12/20/90	15,663	391	506	107	0	15	37	1,208	NC	NC	17,927
07/08/91	12/13/91	9,115	157	555	48	12,290	16	41	936	NC	NC	23,158
08/03/92	01/01/93	18,266	935	511	101	0	109	12	1,089	NC	NC	21,023
08/02/93	12/24/93	8,839	1,110	478	152	6,810	3	5	873	NC	NC	18,270
08/01/94	12/15/94	32,607	489	531	181	0	42	12	1,647	18	13	35,540
08/01/95	12/21/95	18,925	181	892	144	12,690	52	8	745	40	3	33,680
07/29/96	12/05/96	17,395	125	754	60	0	261	10	1,232	45	0	19,882
07/17/97	12/17/97	15,152	191	699	45	1,988	22	14	883	42	3	19,039
07/20/98	12/22/98	21,695	60	550	51	0	29	19	1,145	47	0	23,596
07/19/99	12/15/99	12,839	52	530	192	962	45	4	716	45	0	15,385
07/17/00	12/15/00	23,726	117	712	78	1	52	9	2,052	51	1	26,799
07/16/01	12/14/01	50,434	97	1,119	42	12,475	345	22	2,072	63	1	66,670
07/19/02	12/14/02	44,152	126	765	177	0	387	21	1,491	90	1	47,210
07/18/03	12/12/03	31,443	115	889	50	18,857	133	13	1,176	92	0	52,768
Average Yearly Totals:		Coho	Coho jacks	Chinook	Chinook jacks	Pink	Chum	Sockeye	Steelhead	Bull Trout	Cutthroat	
		17,068	204	646	195	6,338*	40	15	781	53	2	

NC = no count

*The average of odd-year Pink salmon returning to Sunset Falls.

2003 FISHWAY MAINTENANCE, MAJOR REPAIRS AND MODIFICATIONS

During the 2003 construction season, maintenance, major repairs, and modifications were performed on the following WDFW-owned fishways:

Cedar Creek (WRIA 27) Fishway Modifications and Repairs

Built in 1956, under the Mitchell Act, the Cedar Creek fishway provides salmon and steelhead access to 15 miles of spawning and rearing habitat. Prior to installation of the fishway, the falls/cascades were a complete block to fall chinook salmon and a partial barrier to coho and steelhead. The fishway is a vertical slot design with 12 concrete pools. During the 2003 project season, a new attraction flow gate was fabricated and installed at the entrance of the fishway in order to better guide the fish through the facility. Extensive concrete repairs were completed to the floor of the fishway to repair vortex scour holes adjacent to the base of vertical slots. In addition, both organic and inorganic debris was cleaned out of the entire fishway to facilitate fish passage.

Wind River (WRIA 29) Fishway at Shipperd Falls Modifications and Repairs

Completed in 1958 under the Mitchell Act, the Wind River fishway at Shipperd Falls has been in service for 44 years. The facility provides spring chinook and summer steelhead access to 38 miles of spawning and rearing habitat.

In 2001, a severe storm event resulted in several tons of large rocks falling onto the lower portion of the fishway from an adjacent cliff. The resulting damage from the rockslide included broken cover grates and concrete damage to the fishway. Evergreen Aviation was contracted to fly WDFW staff to the fishway by helicopter, to remove and replace the damaged grates. Additional equipment and material were flown in to effect concrete repairs to the fishway.

East Fork Humptulips (WRIA 22) Fishway Repair

Built in 1965, under a cooperative agreement between the U.S. Forest Service and the former Washington Department of Fisheries, the East Fork Humptulips River fishway provides salmon and steelhead access to over 16 miles of spawning and rearing habitat over a 14-foot high falls. Flood flow events through 2001 damaged several concrete weirs and the separating wall of the fishway. During the summer of 2003, WDFW construction crews repaired the concrete damage and improved the access trail to the fishway. The work resulted in restoring fish passage and prolonging the life of the fishway.

Mitchell Act Stream Clearance and Fishway Operation and Maintenance

This project provides for the overall inspection, maintenance and repairs of the 24 formal fishways constructed under the Mitchell Act in the lower Columbia River drainage. Between January 1 and December 31, 2003, a total of 10.6 staff months were spent on the aforementioned efforts. The program is currently seeking federal funding for major deferred

maintenance associated with fishways that have been in service for close to a half a century.

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT) FISH PASSAGE INVENTORY

In 1991, the Washington State Legislature, working with the Washington State Department of Transportation (WSDOT) and the Washington State Department of Fisheries (WDF, prior to merger with Department of Wildlife), provided for a fish passage inventory on Washington State Highways. The purpose of the ongoing inventory is to document fish passage problems at state highway stream crossings, and to correct inventoried passage problems in order of highest priority.

During the ongoing WSDOT inventory 4,590 state highway crossings have been inspected; 2,533 crossings have been identified as fish bearing, including 1,112 identified as fish passage barriers. The second phase of the ongoing project involves conducting habitat surveys, both downstream and upstream of identified barriers, to quantify the habitat gain, which is then used to establish priorities for barrier correction.

Three methods of habitat assessment are used; Full Physical Surveys, Threshold Determinations (TD), and Expanded Threshold Determinations (ETD), per the *WDFW Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual* (August 2000, located on the Internet at: <http://www.wa.gov/wdfw/hab/engineer/habeng>). The Full Physical Survey and ETD are used to qualify and quantify habitat, while the TD verifies a significant reach of habitat (200 m) exists both downstream and upstream of a barrier culvert crossing. Based on results of surveys completed to date, sufficient habitat gains have been identified at 751 barrier features (culverts and/or non-functional fishways) to justify prioritized near-term correction. Another 110 fish barrier crossings are scheduled for further evaluation to determine status for fish passage repair. The remainder of identified barriers are identified as lower priority, with short-term correction deferral, or to be done coincident with other road work in the vicinity.

Since the inventory began in 1992, WSDOT and WDFW's Technical Applications Division has provided fish passage at 124 priority sites. During the 2003 construction season, two WSDOT fish barriers were corrected by WDFW, including Fletcher Creek and an unnamed tributary to Big Creek (Olympic Peninsula).

More information about the WSDOT fish program, barrier correction efforts, and WSDOT Fish Passage Progress Reports are posted on WSDOT's Internet website located at: http://www.wsdot.wa.gov/environment/fishpass/state_highways.htm.

WDFW WILDLIFE AREA (WLA) FISH PASSAGE AND SCREENING INVENTORY

During the past 62 years, WDFW has acquired and/or entered into land management agreements for approximately 840,000 acres of land associated with wildlife area sites, scattered throughout nearly every county in the state. Because of prior land use practices and the increasing awareness of fish passage and fish health issues, TAPPS initiated a statewide inventory of fish passage barriers and water diversions on all state owned or managed lands in October of 1997. The purpose of the inventory is to document and correct all agency-owned fish passage problems and water diversions not currently meeting screening criteria. Washington State law (RCW 77.16.220, RCW 75.55.040, RCW 75.55.060, and RCW 75.55.070) requires all diversions from waters of the state to be screened to protect fish, and that all human-made structures in streams be provided with a durable and efficient system for fish passage.

To date, inventories have been completed on the Snoqualmie, Olympic, Methow, Skagit, Sunnyside, Shillapoo, LT Murray, Cowlitz, South Puget Sound, Lake Terrell and Tennant Lake wildlife areas. In 2003, work was completed on the Skagit, Cowlitz, South Puget Sound, Lake Terrell and Tennant Lake wildlife areas. Reports were generated for inventories for each of these wildlife areas, outlining the number and types of features identified on waters of fish bearing or unknown fish bearing status as well as whether corrective action is required.

Work on the inventory of the Sinlahekin WLA began in 2001 and approximately 65 percent of the fieldwork was completed before inclement weather ended the effort in December 2001. Work on the Sinlahekin WLA will resume in 2004. Inventory efforts on the Oak Creek WLA were curtailed in December of 2003 due to weather and will resume in 2004.

FISH PASSAGE INVENTORY INFORMATION MANAGEMENT

Fish passage barrier and screening inventory data are entered into the Fish Passage and Diversion Screening Inventory (FPDSI) Database. The FPDSI is the central repository for data associated with fish passage barrier and diversion screening inventories. It is intended to provide a common framework for collection, storage, retrieval, and dissemination of information pertaining to the location and fish passage barrier status of culverts, dams, fishways, and other human-made structures.

The FPDSI includes data compiled from several WDFW inventory efforts as well as data from a variety of non-WDFW inventory efforts. The data are statewide in scope but do not represent a comprehensive or complete inventory of fish passage features. For example it is estimated the FPDSI currently contains information on only 15 - 20% of the potential culvert crossings existent within the state. To date, more than 18,000 culvert crossings have been identified and assessed within Washington's waterways. As inventory efforts continue these numbers will increase. Data stored in the FPDSI database is maintained for agency and public use through the Science Division of the WDFW Habitat Program.

MAJOR FISH PASSAGE PROJECT DEVELOPMENT

Snyder Canyon (WRIA 30) Mill Site Fish Passage Project

The old Klickitat Mill, located in the town of Klickitat in south central Washington, burned down during the 1990's and soon after became the focus of a large-scale fish passage project. The Klickitat Mill and associated problems upstream have for the most part blocked anadromous fish from accessing the high quality headwaters of Snyder Canyon Creek. This project went into planning stages in fall of 2002 and construction work began in summer 2003. The job consisted of modifying four separate fish passage problems on Snyder Canyon Creek, including the large 788.6-meter concrete flume of the mill site, a low head dam located just above the flume, and two additional barrier culverts further upstream at 1019.7 meters and one at 1923.9 meters.

The Klickitat Mill site required a large amount of project preparation due to the presence of endangered species, hazardous waste, archaeological surveys, and historical preservation issues. This required a biological assessment and opinion from NOAA Fisheries and the Fish and Wildlife Service, Department of Ecology Decision Recommendations from the Toxics Cleanup Program, and consulting work from state and private archeological and historical specialists.

Construction necessary to resolve these fish passage problems was extensive. Workers installed log grade control structures, installed concrete baffles in the flume, removed the low head dam upstream and redistributed bedload material impounded upstream of the dam, and replaced two upstream private culvert crossings with bridges. The project was an impressive cost share effort on the part of the Yakama Nation, Klickitat County, Mid Columbia Regional Enhancement Group, and Washington Department of Fish and Wildlife. Four separate grants were pooled to fund the project. Work is not yet complete; additional project funding is being solicited and plans are underway to resume work in summer of 2004.

LT Murray Wildlife Area

Robinson Canyon-Ainsley Creek (WRIA 39)

In 2003, all man-made fish passage barriers were removed from the Robinson Canyon watershed, on the LT Murray Wildlife Area, in Kittitas County. This project included the removal of seven barrier culverts from fish bearing streams on WDFW-owned land, the removal of road cross-drain culverts on Type 4, 5 and 9 streams, the placement of large woody debris at appropriate locations, and replanting of all disturbed areas. As a result, 7.85 miles of stream-adjacent road was formally abandoned.

North Fork Manastash Creek (WRIA 39)

Design, permitting and scheduling are underway for fish passage restoration and habitat enhancement work on LT Murray Wildlife Area land on North Fork Manastash Creek, with anticipated completion in 2004. Scoping, design, permitting, and scheduling work continues for restoration on other watersheds on the LT Murray Wildlife Area. This work requires coordination with wildlife area managers and the Washington Department of Natural Resources (DNR), to ensure mandated Road Maintenance and Abandonment Plan (RMAP) requirements are met.

Taneum Creek (WRIA 39)

Habitat project scoping continues on the Taneum Creek watershed. Plans currently include the abandonment of approximately six miles of relic logging road, removal of four barrier culverts on fish-bearing streams, and removal of culverts at numerous Type 4, 5 and 9 stream crossings. Large woody debris will be placed as habitat enhancement where culverts are removed at all locations.

Sunnyside Wildlife Area

Design, permitting, and scheduling are underway for the removal of a barrier culvert on Wendell-Phillips Creek (DID 7), on the Sunnyside Wildlife Area near Yakima. This project is scheduled for 2004 completion.

Snoqualmie Wildlife Area

Cherry Valley (WRIA 07) Unit

Up to 21 culverts and one dam are proposed for removal or retrofit for fish passage, to be completed in 2005 or 2006. Additionally, channel restoration will be done, associated with the culvert removal, including reconstruction, riparian planting and instream wood placement. This would consolidate several dredged ditches into a restored stream channel, which will improve rearing habitat and adult passage to upstream spawning habitat (with documented coho spawners and chinook juveniles). Existing man-made ponds will be connected to the restored channel, which will likely reduce juvenile stranding that currently occurs. The proposed projects would benefit ESA listed chinook juveniles, coho juveniles and adults, steelhead and resident trout. Opportunities for stream and wetland habitat restoration are also being explored with the WDFW Wildlife Program, adjacent landowners, Washington Trout and Ducks Unlimited.

Stillwater (WRIA 07) Unit

TAPPS/ERTA proposes to remove two culverts, replace three culverts with fish passage structures, replace one culvert with a steel foot bridge and remove or retrofit one dam (culvert with half-round riser) for fish passage. The proposed projects, expected to be completed in 2005 or 2006, would primarily benefit coho juveniles and resident trout, by providing access to rearing habitat and flood refuge.

WILD STOCK RESTORATION/ENHANCEMENT

METHODOLOGY

Site Inventory

The wild stock, off-channel habitat inventory effort was initiated in 1989 and continued through September 2003. The habitat inventory techniques described below were used by both the North

Sound and North Coast programs. U.S. Geological Survey topographic maps were used to split each river system into convenient reaches for surveys with break points at principal river meanders and other topographic breaks. Each reach was numbered starting at the mouth and moving upstream. Within each reach, each site inventoried was coded to river, reach, bank (L or R), and its sequential number examined in that reach. Therefore, a typical code might be "SK-7-LB3" denoting site number 3 (the third site examined) in reach number 7 on the left bank of the Skagit River. Precise rules for coverage were developed and updated as necessary so decisions could be quickly made for what habitat was to be included and excluded (already mapped or described). In addition to habitat documentation and possible project ideas, the surveys specifically described fish passage/blockage structures for data entry into the FPDSI program, the agency catalog for this information.

Aerial photos and U.S.G.S. maps were used to identify potential off-channel spawning and rearing habitat. Field surveys were then conducted to locate and confirm the existence of specific habitat. The land adjacent to each bank of the river is divided into a series of manageable areas. Each area is separated from the next by a distinct geographic landmark (e.g., high cut bank, tributary, bend in the river, bridge, etc.). Within each area are a number of specific habitat sites (channels, ponds, etc.). The areas within a river system and the sites within each area are identified, using an alphanumeric system, beginning at the mouth of each river. For example, H-L1-1 describes a site along the (H) Hoh River, which is on the (L) left bank as you face downstream. The first (1) identifies the first group of habitat sites moving upstream from the mouth and the second (1) identifies the first site within that area. In most cases, local names are also used to help identify the sites. Any sites found on tributaries to the mainstems have existing WRIA numbers included in the site identification name. If the waters are unnumbered they are given a tentative WRIA number.

Each site which has existing and/or potential fish habitat is surveyed, and data on characteristics such as flood susceptibility, water source and quantity, water quality, juvenile fish access and current use, channel entrance conditions, machinery accessibility, substrate type are recorded. The evaluations for potential enhancement projects are based, in part, on this information. Since many sites are de-watered, or nearly so, during the summer, follow-up surveys sites are conducted after the onset of the autumn rains to provide additional information on water levels and flow.

Project Design

Each proposed project is rigorously reviewed by a team consisting of a HETA Engineer and the lead ERTA Environmental Specialist. Once the projects are approved for development, an engineering survey of the site is conducted and a preliminary design is produced by the Business Services Program. After final review and approval of the design by the project team, land-use agreements are negotiated and applications are submitted for the necessary environmental permits. A project time line is developed that identifies the date for materials purchasing and construction.

NORTH SOUND

NORTH SOUND HABITAT INVENTORY

A major product of our program has been an inventory of the undocumented off-channel habitat in the Skagit and Stillaguamish River basins. The inventory effort also identified specific habitat enhancement project sites, some of which have been developed. Because off-channel habitat areas are generally small, they were not included in the WDFW Stream Catalog (Williams et al., 1975) that was based on topographic maps or work of other stream survey inventories such as Johnson (1986). The new information obtained on the Skagit supplements the Stream Catalog and Johnson (1986) so all anadromous salmonid habitat in this basin has been identified and described. The inventory effort to supplement the Stream Catalog in the Stillaguamish has been only partial since funding for this effort was eliminated in September 2003.

The new off-channel habitat information collected was entered into a database developed within the TAPPS Division to be available for all resource managers on request. The Skagit data was further refined by the Skagit System River Cooperative to be available as a GIS layer. The Skagit database includes all information collected by this program including early work recorded in other formats. The current storage and retrieval system allow this habitat information to be easily accessed and incorporated into land use decisions, plans, permits and practices so these areas can receive the highest level of protection possible. A long range plan is to make the information available on the WDFW internet site. No conversion of the Stillaguamish data has been made. Off-channel habitat has been frequently overlooked yet provides valuable areas for the production of native salmonids.

Documented habitat, such as that previously identified in the Stream Catalog, was the basis for identifying the associated or nearby undocumented areas. Aerial photos and topographic maps were then used to identify prospective sites not previously described. In the field, the prospective areas were examined for habitat type and value and the immediate area searched for habitat not visible on aerials and published maps. All undocumented areas providing habitat for salmonids were then surveyed and mapped. Variables measured are shown on the sample field form in Attachment 1. Currently, only the descriptive field form has been entered into the database (and any passage/blockage structure(s) into FPDSI). The drawn maps of each site and associated copies of topographic maps and aerials have been retained in hard copy files. In the future, the hard file information may be scanned and stored in a digital format attached to the form.

NORTH SOUND ENHANCEMENT PROJECT IDENTIFICATION

Our intensive habitat inventory work identified a number of enhancement project sites. We also found possible projects from general review of aerial photos and foot surveys in likely locations. Aerial flights using both fixed-wing and helicopters were also helpful in locating opportunities, especially where access was limited. References from other professional biologists in the field were often quite useful too. Fish passage improvement work came to be a high priority in recent years.

Listings of habitat enhancement options were annually ranked by potential habitat gain and fish production, level of design difficulty and construction, landowner considerations, expected project

life, cost, potential funding opportunities/constraints and related factors. Listings have been dynamic with new possibilities continually being added and others dropped based on additional evaluation.

The highest priority sites were usually studied for at least a year to verify limiting production factors and to gather site specific data required for design and construction considerations. Only projects with high long term production potential have actually been built. The TAPPS habitat enhancement efforts have tended to focus on the more difficult and/or high-risk projects unlikely to be completed by another program or agency. These projects have needed longer term planning, design development, survey, flow monitoring, data gathering, and evaluation.

NORTH SOUND ENHANCEMENT PROJECT EVALUATION

All projects were evaluated for fish production either through measured observations of juveniles or total enumeration of smolts and/or regular surveys of spawners. Some sites had engineering evaluation of hydraulic parameters. National Marine Fisheries Service (NMFS) and the University of Washington School of Fisheries (UW) also evaluated specific project sites. However, budget constraints in 2003 precluded further WDFW evaluation work for either fish production or engineering design. Evaluation data for fish production through 2002 was reported in the 2002 Annual Report. Results from NMFS and UW investigations is available directly from them. Engineering evaluation is on file with the Habitat Program. Future evaluation work will depend on available funds and interest of outside programs.

NORTH SOUND PROJECTS COMPLETED

All North Sound project sites completed in this program since 1986 are shown on the map in Figure 1. A list of these projects is found in Table 3.

2003 NORTH SOUND PROJECT CONSTRUCTION

Stillaguamish River Basin

Fortson Creek

The Fortson Creek site consists of a fishway at the outlet of several old mill ponds with an outlet channel stepped down to the Stillaguamish River with a series of log weirs. Avulsion of the river in 2001 captured and degraded the lower end of the channel such that the most downstream weir became a passage barrier, especially to adult chum salmon. Fortunately, sufficient channel length remained between the lowermost log control and the river to insert one more log control to correct this problem. The needed control was added in 2003 to restore efficient and durable fish access and to preserve the integrity of the lowermost weir before it was undermined and potentially failed. The Fortson site is heavily used by chum, pink and coho salmon, and is the most productive coho site on the North Fork Stillaguamish River.

Skagit River Basin

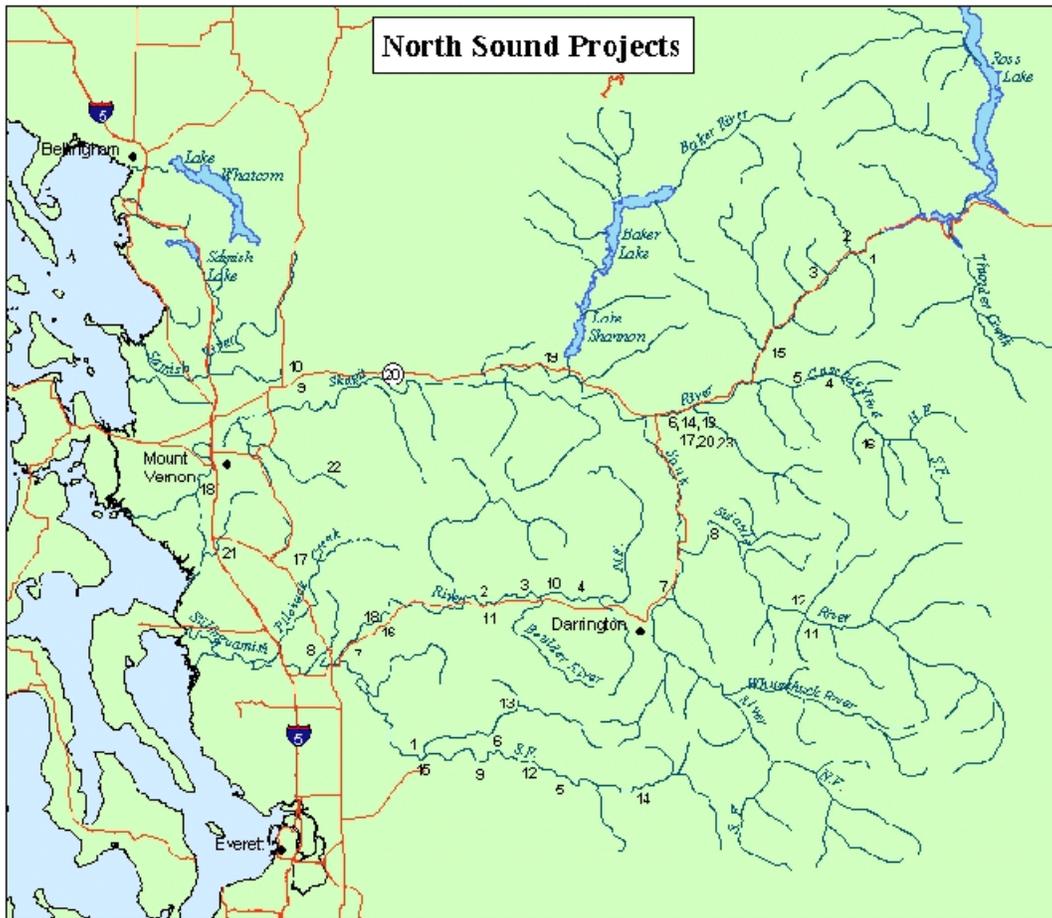
Powerline Channel

The Powerline project was a combination slough restoration and off-channel spawning habitat creation project on the upper Skagit near Rockport. It was located near the Illabot Channel projects built in 1995 and 2001. The slough was cut off from the river, had no outflow and no longer functioned as fish habitat. Project work included excavation of the slough to its former level and development of a circular spawning area at the upper end. Groundwater percolation from both the spawning area and slough provided sufficient flow to restore the site to active status that could provide the off channel functions of both spawning and rearing habitat.

Fish response was immediate with juvenile coho colonization immediately after construction. Adult coho and chum salmon followed in the fall with use throughout the site.

Ray Johnson Slough

The Ray Johnson Slough was purchased by Seattle City Light in 2001 to preserve its active function as off-channel habitat before being lost to development activities. Although somewhat impacted by farming activities, it largely remains in its original condition. Project work in 2003 was to remove an old earthen fill from one part of the slough that had been used for an equipment crossing. Removal restored natural flow to several hundred feet of the slough that had previously only been watered during very high flow events. Chum salmon colonized the reopened area in fall spawning on the available gravel and percolation.



Project Locations

Projects Completed Through 2003

- | SKAGIT BASIN SITES | STILLAGUAMISH BASIN SITES |
|--------------------------|--------------------------------|
| 1. Park Slough Extension | 1. Granite Falls |
| 2. Newhalem Ponds | 2. Rowan Pond |
| 3. County Line Ponds | 3. Hazel Pond |
| 4. Cascade Park | 4. Fortson Ponds |
| 5. Cascade Mill Pond | 5. Gold Basin |
| 6. Harrison Pond | 6. Marsh Creek |
| 7. Constant Channel | 7. Spring Creek (2 proj.) |
| 8. Suiattle Slough | 8. Kackman |
| 9. Carey's Slough | 9. Canyon Passage |
| 10. Little Carey's Creek | 10. Oso Pond |
| 11. Marsh Pond | 11. Rowan Creek Restoration |
| 12. Boundary Creek | 12. Trout Creek |
| 13. Illabot Channel | 13. Mud Lake |
| 14. Barnaby Slough | 14. Dazzling Howie |
| 15. Taylor Channel | 15. Lake Bosworth |
| 16. Grouse Marsh | 16. Schoolyard Creek (3 proj.) |
| 17. O'Brian Slough | 17. Pilchuck Tribs. (2 proj.) |
| 18. WF Church Creek | 18. Koorz |
| 19. Lomezan Creek | |
| 20. Illabot-2 | |
| 21. Bulson x-trib | |
| 22. Walker Creek | |
| 23. Powerline Channel | |



Figure

Figure 1. North Sound Projects

Table 3. Completed North Sound projects through 2003

Project	River Basin	Year Completed	Habitat Benefit (m ²)	Cost	Landowner
<i>Skagit River Basin</i>					
Newhalem	Skagit R	1991	81,000 m ²	\$283,000 ^a	Seattle City Light
Powerline Channel	Skagit R	2003	7,000 m ²	\$300,000	Seattle City Light
County Line Ponds	Skagit R	1991, 1996	22,000 m ²	\$114,000 ^a	Seattle City Light
Cascade Park	Cascade R	1991	2,030 m ²	\$14,764 ^a	Cascade Park Association
Cascade Mill	Cascade R	1989	7,000 m ²	\$27,200 ^b	Keller
Barnaby Slough	Skagit R	1995	26,302 m ²	\$41,490 ^a	WDFW
Harrison Pond	Skagit R	1990	141,600 m ²	\$68,120 ^c	Seattle City Light
Harrison Pond	Skagit R	1995	(included w/ Harrison 90)	\$100,000 ^a	Seattle City Light
Illabot Channel	Skagit R	1995	1,672 m ²	\$160,377 ^a	Seattle City Light
Constant Channel	Sauk R	1991	2,800 m ²	\$130,000 ^{a e}	USFS
Suiattle Slough	Suiattle R	1988	3,120 m ²	\$68,270 ^c	WA DNR
Careys ^d	Skagit R	1986	169,000 m ²	\$15,240 ^b	City of Hamilton
Little Careys	Skagit R	1991	1,920 m ²	\$13,400 ^{a e}	Crown Pacific
Marsh Pond	Suiattle R	1992	3,800 m ²	\$32,000 ^{a e}	USFS
Boundary	Suiattle R	1994	830 m ²	\$41,092 ^{a e}	USFS
Park Slough Extension	Skagit R	1992	1,400 m ²	\$78,000 ^a	NPS
Grouse Marsh	Cascade R	1996	13,150 m ²	\$101,214 ^a	USFS
O'Brian Slough	Illabot Cr	1998	300 m ²	\$30,575	Seattle City Light
Barnaby 2 Slough	Skagit R	1998	2,868 m ²	\$10,612	WDFW
Harrison Slough	Skagit R	1998	200 m ²	\$11,907	Seattle City Light
Taylor Channel	Skagit R	1998	5,694 m ²	\$437,260	USFS
Lornezan	Skagit R	1999	18,000m ²	\$118,139	Skagit County
Barnaby 2+ Slough	Skagit R	2000	(included w/ B2)		WDFW
Illabot Channel Extension	Skagit R	2001	2,430m ²	\$530,864	Seattle City Light
Unnamed trib to	Skagit R	2002	45,616m ²	\$750,000	WSDOT

Table 3 (continued). Completed North Sound projects through 2003

Project	River Basin	Year Completed	Habitat Benefit (m ²)	Cost	Landowner
Bulson					
Unnamed trib to Walker	Skagit R	2002	30,951m ²	\$15,209	Schacht-VanHine
TOTAL SKAGIT BASIN			590,733 m ²		
<i>Stillaguamish River Basin</i>					
Granite Falls	SF Stillaguamish R	1988,93	17,900 m ²	\$20,880 ^b	McEwen, Indian Hills Community Park
Rowen Pond	NF Stillaguamish R	1992	4,000 m ²	\$38,300 ^c	Charley
Hazel Pond	NF Stillaguamish R	1987	9,580 m ²	\$17,280 ^c	Snohomish County
Fortson Ponds ^d	NF Stillaguamish R	1989, 1990, 1992, 1993, 2003	47,180 m ²	\$3,585 ^b	WDFW
Gold Basin	SF Stillaguamish R	1989	5,000 m ²	\$51,710 ^{b e}	USFS
Stilly Canyon	SF Stillaguamish R	1994	60 miles	\$34,523 ^a	Hancock
Oso Pond	NF Stillaguamish R	1994	32,368 m ²	\$31,382 ^a	Snohomish County
Spring Creek Culvert	SF Stillaguamish R	1994	32,300 m ²	\$21,518 ^{a e}	Snohomish County
Spring Creek Dikes	SF Stillaguamish R	1993	32,300 m ²	\$43,500 ^a	Folker, Wheatley
Kackman Creek	Stillaguamish R	1993	1,920 m ²	\$15,500 ^{a e}	Klein
Rowen Creek	NF Stillaguamish R	1995	156 m ²	\$49,193 ^a	Phillips
Fortson Ponds ^d	NF Stillaguamish R	1995	200 m ²	\$11,593 ^a	WDFW
Big Four Creek	SF Stillaguamish R	1995	220 m ²	\$5,360 ^a	USFS
Marsh Creek	SF Stillaguamish R	1993	100,000 m ²	\$93,200 ^{a e}	Snohomish County
Trout Creek	SF Stillaguamish R	1996	28,000 m ²	\$99,186 ^a	Snohomish County
Jordan Creek	SF Stillaguamish R	1996	400 m ²	\$7,302 ^a	Lundberg
Trout Farm Creek	SF Stillaguamish R	1996	200 m ²	\$3,651 ^a	Brenner

Table 3 (continued). Completed North Sound projects through 2003

Project	River Basin	Year Completed	Habitat Benefit (m ²)	Cost	Landowner
Mud Lake	SF Stillaguamish R	1997	500 m ²	\$22,870	Hancock
Dazzling Howie	SF Stillaguamish R	1998	1,247 m ²	\$126,374	Snohomish County
WF Church Creek	Stillaguamish R	1998	42,514	\$17,101	WSDOT
Schoolyard WSDOT	NF Stillaguamish R	1999	2,377	\$360,289	WSDOT
Schoolyard Timm	NF Stillaguamish R	1999	Included w/ Schoolyard WSDOT	\$59,883	WSDOT
Schoolyard Bergstrom	NF Stillaguamish R	1999	Included w/ Schoolyard WSDOT	\$54,897	Bergstrom
Lake Bosworth	SF Stillaguamish R	1999	25,000m ²	\$144,020	WDFW
Pilchuck #1	NF Stillaguamish R	2000	8,118m ²	\$70,992	Secret Creek Estates
Pilchuck #2	NF Stillaguamish R	2000	22,480m ²	\$52,805	Secret Creek Estates
Koonz	NF Stillaguamish R	2002	21,689m ²	\$323,680	Towne
TOTAL STILLAGUAMISH BASIN			403,349m ²		
TOTAL NORTH SOUND			994,082 m ²		

^aCost figure includes design, development, construction and post project evaluation as recorded by WDFW accounting system (AFRS) which began in 1991 for individual projects.

^bCost figure developed from methodology of Sekulich (1991) which approximates AFRS closely for work completed before 1991.

^cCost figure is a combination of AFRS and Sekulich (1991) because portions of the project were completed before and after 1991.

^dOnly that portion of the project completed in this program is included.

^eProject cost shared with another contributor(s).

NORTH SOUND SCHEDULED 2004 PROJECTS

Skagit River Basin

Charley Moses Channel

The Charley Moses site on the upper Skagit upstream of Marblemount provides an opportunity for another groundwater channel that may be constructed in 2004 or 2005. It will be about 1,000 feet in length. It will be built in cooperation with Seattle City Light and a group of landowners collectively coordinated through the Bureau of Indian Affairs.

NORTH COAST

The TAPPS Division has developed 16 projects in the Hoh River system to date. These projects have the potential to produce about 20 percent of the estimated total coho smolt production in the Hoh watershed. In the Quillayute system TAPPS has built 29 projects that have the potential to produce over 10 percent of the total smolt output. In the Bogachiel River alone, nine projects have the potential to produce about 20 percent of the total coho smolt output.

HABITAT INVENTORY

During 2003, off-channel rearing habitat inventory work was conducted on the West Fork Dickey River tributaries and Elk Creek, a major coho producing tributary of the Calawah River. Inventory data are loaded into a database and are available to resource managers. This database has improved WDFW's ability to protect key salmonid producing habitat. To date, habitat inventory work has been completed on about 85% of the North Coast river systems.

This habitat inventory information has become a key component of the Watershed Analysis process being conducted on these river systems. All new habitat sites are being identified and cataloged with the water resource inventory area (WRIA) numbering system, which is the standard identifier for all waters of the State. The inventory has located many miles of previously undocumented waterways. These streams have been assessed for fish use and then recommended for water type classification and inclusion into the state Department of Natural Resources water type maps. In some cases, fish use can be documented in streams that have been previously classified as non-fish bearing. This information assists Regional Habitat Biologists in their efforts to protect critical fish habitat.

Providing fish passage at human-made barriers, such as poorly designed culverts, has become a high priority. Any human-made fish barriers encountered during our surveys are documented and included in the FPDSI fish passage database.

Hoh River Overview

The adult coho escapement to the Hoh River in the fall of 2002 was 9,416 fish; estimates for 2003 indicate over 6,900 fish. (Mike Gross, WDFW, personal communication). This is the eleventh time in the past thirteen years that the escapement has been greater than 4,000 fish, (Figure 2). The 10,000 coho escapement in 2001 was the highest in 28 years. The escapement goal is between 2,000 and 5,000 fish. Using a measured mean production of 0.22 smolts per square meter, the 16 projects on the Hoh are capable of producing about 20 percent of the total smolt output of the entire watershed.

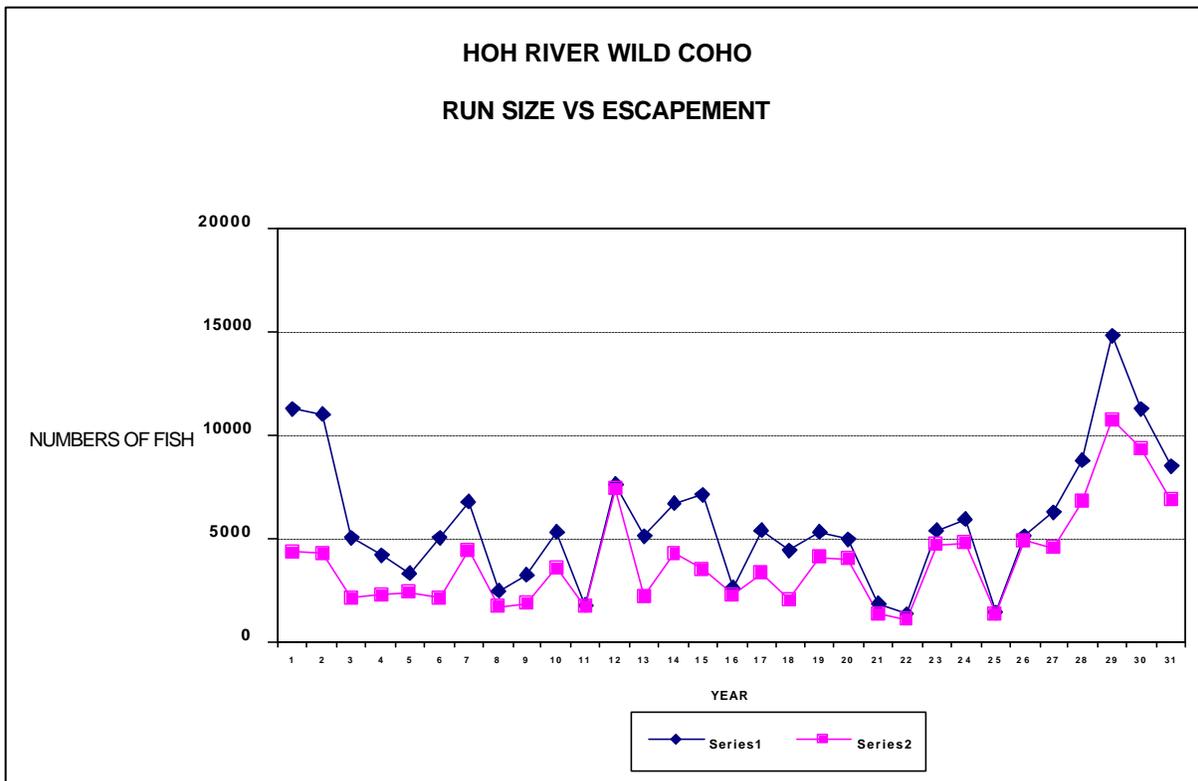


Figure 2. Hoh River wild coho run size and escapement for the years 1973 to 2003

Quillayute System Overview

The Quillayute watershed consists of the Quillayute mainstem, Dickey, Sol Duc, Calawah, and Bogachiel rivers. Coho escapement for 2002 was good and probably resulted in good recruitment of juveniles to off-channel habitat in the autumn of 2003. Spawner returns in 2003 were strong. No juvenile fish traps were operated in this river system due to budget constraints. The mean smolts per square meter measured at selected project sites is about 0.35. Using the 29 project sites within the entire watershed, TAPPS personnel calculates that they are producing about 10 percent of the total Quillayute smolt output. The nine projects on the Bogachiel are estimated to be producing close to 20 percent of its entire smolt yield.

2003 NORTH COAST CONSTRUCTION PROJECTS

Project costs and habitat benefitted for the 2003 projects is summarized in Table 3. An entire list of projects constructed since 1988 are shown in Figure 3, with details on each project shown in Table 4.

Darrow Marsh

This project, on a tributary of the West Fork Dickey River, resulted in the creation of additional rearing habitat in a high quality spring-fed channel by using cedar plank weirs to backwater the existing shallow water habitat.

Fletcher Creek

In this tributary of the Hoh River, metal baffles were installed in a concrete box culvert, which passes the creek flow under Highway 101. These baffles eliminate sheet flow in the culvert and will make fish passage much easier. This was a cooperative project with WSDOT.

Maintenance

Existing project sites were inspected for maintenance needs and work was performed as needed using a crew of laborers from the Clearwater Corrections Center near Forks. Stumps and other woody debris were added to projects that appeared to have inadequate cover.

Table 3. North Coast habitat enhancement projects completed in 2003

Project	River Basin	Project Type	Habitat Benefitted (m ²)	Project Cost	Landowner
Darrow Marsh	West Fork Dickey	Habitat Enhancement	4,300 m ²	\$29,700	Rayonier Timber
Fletcher Creek	Hoh	Fish Passage	1,400 m ²	\$19,000	WSDOT
Totals			5,700 m ²	\$48,700	



Project Locations

Projects Completed Through 2003

- | | | |
|-----------------------------|--------------------------|-------------------------------|
| 1. Airport Pond | 21. Calawah Springs | 41. Thomas Springs |
| 2. Rayonier Pond | 22. Colby Springs | 42. Big Beaver Springs |
| 3. Barlow Pond | 23. Elkhorn Pond | 43. Prairie Fall Creek |
| 4. Anderson Ponds | 24. West Fk. Marsh Creek | 44. Labrador Creek |
| 5. Pole Creek | 25. Hoh Springs | 45. M&R Springs |
| 6. Peterson Pond | 26. Suot Creek Springs | 46. Muselby Springs Extension |
| 7. Dismal Creek Pond | 27. T-Bone Springs | 47. Lear Creek Springs |
| 8. Anderson Creek Channel | 28. Young Slough | 48. Lake Creek Springs |
| 9. Nolan Pond | 29. Lawie Channel | 49. Peauo Springs |
| 10. Wilson Springs | 30. Tassel Springs | 50. Nolan Springs |
| 11. Tall Timber | 31. Lafurist Pond | 51. Darlow Marsh |
| 12. Smith Road Pond | 32. Nolan Channel | 52. Fletcher Creek |
| 13. Dahlgren Springs | 33. Huelsdonk Creek | |
| 14. Morganroth Springs | 34. Manor Springs | |
| 15. West Fk. Dickey Culvert | 35. Cascade Springs | |
| 16. Mosley Springs | 36. Powell Springs | |
| 17. Lear Creek Springs | 37. Rootstock Springs | |
| 18. Upper Mosley Springs | 38. Rayonier Channel | |
| 19. Bogachiel Pond | 39. Tye Channel | |
| 20. Falcon Walrus | 40. Eagle Creek Springs | |



Figure

Figure 3. North Coast Projects

Table 4. Project sites listed on study area map (Figure 3).

Project Site	River Basin	Year Completed	Habitat Benefitted (m ²)	Cost	Property Owner
Airport Pond	Clearwater	1988/89	30,000 m ²	\$16,900	Rayonier
Rayonier Pond	Hoh	1988	4,048 m ²	\$19,000	Rayonier
Barlow Pond	Hoh	1988/89	8,100 m ²	\$26,600	Private
Anderson Ponds	Hoh	1988/89	10,150 m ²	\$45,900	Private
Pole Creek	Hoh	1988/90	6,100 m ²	\$45,300	Forest Service
Peterson Pond	Hoh	1989	2,000 m ²	\$22,500	Private
Dismal Pond	Hoh	1989	4,048 m ²	\$25,700	Rayonier
Anderson Cr Channel	Hoh	1990	3,000 m ²	\$16,500	Rayonier
Nolan Pond	Hoh	1990	8,000 m ²	\$ 3,200	State
Wilson Springs	Bogachiel	1990	3,200 m ²	\$41,600	Private
Tall Timber	Bogachiel	1990	800 m ²	\$10,000	Rayonier
Smith Road Pond	Bogachiel	1990	2,000 m ²	\$15,600	Rayonier
Dahlgren Springs	Bogachiel	1990	600 m ²	\$7,300	Private
* Morganroth Springs	Bogachiel	1991	14,100 m ²	\$13,400	Forest Service
* W.F. Dickey	Dickey	1991	23,000 m ²	\$28,000	Rayonier
* Mosley Springs	SF Hoh	1991	4,048 m ²	\$21,000	State
* Lear Springs	SF Hoh	1991	800 m ²	\$18,100	State
* Upper Mosley	SF Hoh	1992	690 m ²	\$23,000	State
Bogey Pond	Bogachiel	1992	13,640 m ²	\$24,700	Rayonier
Falcon Walrus	Bogachiel	1992,1995	740 m ²	\$20,600	Rayonier
Calawah Springs	Calawah	1992	900 m ²	\$50,300	John Hancock Ins.
Colby Springs	Dickey	1992	9,200 m ²	\$13,500	Rayonier
Elkhorn Pond	Dickey	1992	5,400 m ²	\$9,100	State
WF Marsh Creek	Dickey	1992	3,000 m ²	\$6,200	Rayonier
* Hoh Springs	Hoh	1993,1995	3,450 m ²	\$86,000	Rayonier
Soot Cr Springs	EF Dickey	1993	2,100 m ²	\$64,000	Rayonier
T-Bone Springs	Dickey	1993	745 m ²	\$33,000	Rayonier
* Young Slough	Hoh	1994	3,000 m ²	\$158,000	John Hancock Ins.
* Lewis Channel	Hoh	1994	2,000 m ²	\$135,000	State
Tassel Springs	Sol Duc	1994	600 m ²	\$16,000	Private
Laforrest Pond	Bogachiel	1995/96	2,520 m ²	\$133,000	Private
*Nolan Channel	Hoh	1996	1,800 m ²	\$151,000	Rayonier
*Huelsdonk Creek	Hoh	1996	12,000 m ²	\$18,000	WSDOT
Manor Springs	Clearwater	1996	960 m ²	\$21,550	DNR
*Cascade Springs	WF Dickey	1996	3,000 m ²	\$42,000	Rayonier
*Powell Springs	Sol Duc	1997	2,000 m ²	\$76,000	Rayonier
Rootstock Springs	Calawah	1997	200 m ²	\$12,000	Rayonier

Table 4 (continued). Project sites listed on study area map (Figure 3).

Project Site	River Basin	Year Completed	Habitat Benefitted (m ²)	Cost	Property Owner
(I)					
Rayonier Channel	Bogachiel	1998	1,700m ²	\$135,000	Rayonier
Tyee Pond	Sol Duc	1998	2,800m ²	\$80,000	Rayonier
Rootstock Springs	Calawah	1998	600m ²	\$22,000	Rayonier
(II)					
*Eagle Creek Springs	Sol Duc	1999	2,200m ²	\$84,000	Private
Thomas Springs	Sol Duc	1999	2,800m ²	\$20,000	Private
Big Beaver Springs	EF Dickey	1999	7,400m ²	\$35,000	Rayonier
*Prairie Fall Creek	Sol Duc	2000	4,700m ²	\$148,400	Clallam County
*Labrador Creek	WF Dickey	2000	2,000m ²	\$37,800	Green Crow Timber
*M & R Springs	Sol Duc	2000	700m ²	\$59,900	Merril & Ring Timber
Mosley Springs Extension	SF Hoh	2001	900m ²	\$68,000	DNR
Lake Creek Springs	Sol Duc	2002	500m ²	\$23,900	Rayonier
*Pseudo Springs	MF Dickey	2002	3,300m ²	\$43,100	Rayonier
*Nolan Springs	Hoh	2002	11,750m ²	\$38,400	Rayonier
Darrow Marsh	WF Dickey	2003	4,300m ²	\$29,700	Rayonier
Fletcher Creek	Hoh River	2003	1,400m ²	\$19,000	WSDOT
Total Habitat Benefitted (m ²)			175,039 m ²		

*Cost share projects with timber companies, DNR, WSDOT, Salmon Coalition, Counties and/or Tribes.

NORTH COAST SUMMARY

During 2003, as in the past, the upstream migration of juvenile salmonids into the project sites coincided with the onset of fall storms. Fortunately, December and January were wet enough to charge up the aquifers to adequate levels and keep these important off-channel habitats well watered. The high-quality rearing and spawning areas, which were either created or enhanced in 2003, should provide excellent overwintering habitat for wild juvenile coho and other salmonids.

The evaluation of past projects has provided valuable information on how to improve the design of off-channel, over-wintering habitat enhancement projects so they are more effective. One example would be the observation that predation by waterfowl, otters, and trout may significantly reduce the survival of over wintering coho at our enhancement sites. To remedy this problem, large amounts of complex woody debris are now being incorporated into all projects to provide cover and reduce predation. In addition, nutrient enhancement is being used to bolster food production within some of the newer project sites. We are also learning that the use of hatchery fish carcasses needs to be regulated so we don't overload some of these low waterflow systems.

During 2003, the Clearwater Corrections Center labor crews, which are supervised by the Department of Natural Resources (DNR) and WDFW, were contracted to perform various parts of the hand labor construction including much of the re-vegetation.

Local timber companies and the DNR have been very cooperative in allowing WDFW to conduct habitat inventories and habitat enhancement/restoration work on their properties. In some cases the timber companies have provided funding and/or in-kind service.

Budget constraints terminated further North Coast habitat inventory and project development work effective September 2003.

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